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JEE

LECTURE - 06

Mole Concept

Sarvesh sir

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Q. An element, X has the following isotopic composition:

^{200}X : 90%, ^{204}X : 8.0%, ^{202}X : 2.0%

The weighted average atomic mass of the naturally occurring element X is closest to

A. 202 u

B. 199 u

C. 204 u

D. 200.36 u

D → 33%

B = 34% → X

A = 18%

C = 13% → X

$C_{SD} \rightarrow A_{min} < Avg < A_{max}$

Avg → always → jada percentage wala isotope ke pas hota hai

$$\text{Avg. Atomic wt} = \frac{A_1X_1 + A_2X_2 + A_3X_3}{X_1 + X_2 + X_3}$$

$$= \frac{200 \times 90 + 204 \times 8 + 202 \times 2}{90 + 8 + 2}$$

$$= \underline{200.36}$$

MOLECULAR MASS

sum of atomic mass of all atoms present in molecule

Ex → H_2O

M·wt = 2 × At·wt of H + 1 × At·wt of O

= 2 × 1 + 1 × 16 = 2 + 16 = 18

$C_{SD} = 17$

$$M\cdot wt = \sum A_i X_i = A_1X_1 + A_2X_2 + \cdots$$

where ⇒ A = Atomic wt. of Atom

X_i = suffix numbers (nichhe wale numbers)

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Ex → Calculate M·wt of $C_6H_{12}O_6$

(a) 360 (b) 180 (c) 18 (d) 190

Sol^{n} → M·wt = $\sum A_i X_i = A_1X_1 + A_2X_2 + A_3X_3$

$= 12\times6 + 1\times12 + 16\times6$

$= 180$

$C_{SD} = 18$

① Mass of 1 molecule (single molecule) = M·wt in amu = M·wt amu

(2) Relative mass of molecule = M·wt = M·wt

(3) Mass of 1 mole of molecule = M·wt gram

(4) Molar mass of molecule = mass of 1 mole = M·wt gram

(5) Mass of 22.4 litre gas at S.T.P. = 1 mole = (M·wt) gram

(6) Mass of 6.022×10^{23} molecules = 1 mole = (M·wt) gram

(7) $M \cdot wt = \sum A_i x_i$

Q Calculate mass of 11.2 litre CO_2 gas at S.T.P.

$$\text{Mole} = \frac{\text{wt}}{\text{M.wt}}$$

$$1 = \frac{\text{wt}}{\text{M.wt}}, \quad \text{wt} = \text{M.wt}$$

22.4 litre CO_2 at S.T.P. = 44 gram

11.2 litre = 22 gram

Sol^{n} - (M-1) =

$$\text{Mole of } CO_2 = \frac{11.2}{22.4}$$

$$= \frac{1}{2} \text{ mole}$$

(M-2)

$$\text{Mass of } CO_2 = \frac{1}{2} \times 44$$

$$= 22 \text{ gram}$$

Vol. of gas at S.T.P $\xrightarrow{\div 22.4}$ (Mole) $\xrightarrow{\times \text{M.wt}}$ Mass

		(a)	(b)	(c) ✓	(d)
Q-1	Relative molecular mass of H_2SO_4 →	98g	98amu	98	None
Q-2	Mass of single molecule of H_2SO_4 →	98g	98amu	98	None
Q-3	Mass of (1 mole) of H_2SO_4 =	98gram	98amu	98	None

Q-4 → Mass of 22.4 litre N_2 gas at S.T.P. = (a) 28gm (b) 28 M
(c) 28 (d) None of these

Q-5

Q. 11.35 L of a gas at STP weighs 14 g. The gas could be :

A N_2O = 2×14+1×16 = 44 ✗

B CO = 12+16 = 28

C N_2 = 14+14 = 28

D Both B and C ✓

22.4 litre at S.T.P. = $\frac{14}{11.35} \times 22.4$

= 28 gram

└ M.wt of gas

M.wt of gas = 28 gram

22.4 litre gas at S.T.M.

= M.wt gram

M.wt = 44

(a) CO_2 (b) SO_2

12+32 = 44 32+64 = 96

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Q. 32 gm of SOx occupies 11.2 litre at S.T.P. Assuming ideal gas nature, the value of x is

A 1

B 3

C 2

D 4

Soln

11.2 Litre at S.T.P. = 32 gram

22.4 Litre = 32×2 = 64 gram

M.wt of gas = 64 gram

M.wt of SO_x gas = 32×1 + 16×x

$32 + 16x = 64$

$x = 2$

Q. The formula of an acid is HXO_2. The mass of 0.0242 moles of the acid is 1.657 g. What is the atomic weight of X?

A 35.5 ✓✓

B 128

C 28.1

D 19.0

1 mole of HXO_2 = $\frac{1.657}{0.0242}$ = 68.5

M.wt = $1 \times 1 + A_x \times 1 + 16 \times 2$

= $1 + A_x + 32$

10sec

$A_x + 33 = 68.5$

$A_x = 68.5 - 33$

$A_x = 35.5$

Q. Suppose the elements X and Y combine to form two compounds XY_2 and X_3Y_2. When 0.1 mole of XY_2 weighs 10g and 0.05 mole of X_3Y_2 weighs 9g, the atomic weights of X and Y are

JEE-2019 (mains)

(A) 40, 30

(B) 20, 30

(C) 60, 40

(D) 30, 20

$\Sigma A_i x_i = A_x + 2A_y$

$X + Y \rightarrow$

- $XY_2 \rightarrow 0.1\,mole = 10\,gram$
  $1\,mole = 100\,gram$
- $X_3Y_2 \rightarrow 0.05\,mole = 9\,gram$
  $1\,mole = \frac{9}{0.05} \times 1 = 180\,gram$

$A_x + 2A_y = 100$ — (I)

$3A_x + 2A_y = 180$ — (II)

$-2A_x = -80$

$A_x = 40$

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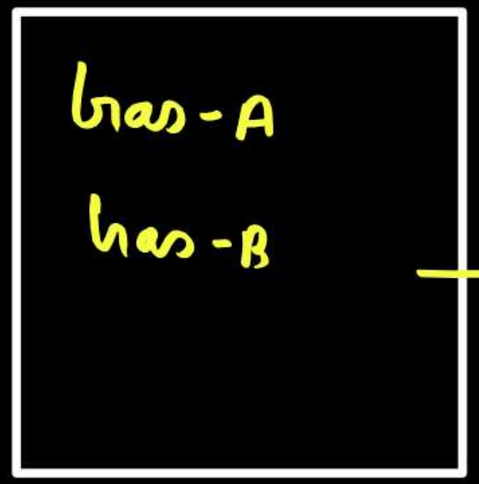
Average Molecular weight

→ M·wt of gas mixture.



→ M·wt of gas mixture
or
Avg. M·wt

$C_{SD} = 19$

$$\text{Avg. M·wt} = \frac{\sum M_i X_i}{\sum X_i}$$

Where → M_i ⇒ M·wt of diff-erent gases

X_i = mole / mole ratio / mole % of different gas

Q-1. 2 mole of He and 4 mole of Ne gas present in a container. Calculate Avg Molecular wt. of gas mixture. $(2^{He^4}, 10^{Ne^{20}})$

Sol^n.

$$\text{Avg. M.wt} = \frac{\sum M_i x_i}{\sum x_i}$$

$$= \frac{4 \times 2 + 4 \times 20}{2+4}$$

$$= \frac{8+80}{6} = \frac{88}{6} = 14.67 \text{ gram / mole}$$

Q. A gaseous mixture contains 3 mole of CO_2 and 6 mole of CO . Average molecular mass of mixture is:

44 $\quad$ 12+16=28

20 Sec → Ans batao

A 17.85

B 21.65

C 19.45

D none of these

$$\text{Avg. M·wt} = \frac{\sum M_i x_i}{\sum x_i}$$

$$= \frac{M_1 x_1 + M_2 x_2}{x_1 + x_2}$$

$$\text{Avg. M·wt} = \frac{3\times 44 + 6\times 28}{3+6}$$

$$= 33.34 \ \frac{\text{gram}}{\text{mole}}$$

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VAPOUR DENSITY

density

- Absolute density or density
- Vapour density
- Relative density

Density (d) = $\frac{\text{Mass}}{\text{Volume}}$

unit = $\frac{g}{ml}$ or $\frac{g}{litre}$ or $\frac{kg}{litre}$

V.D. = $\frac{\text{Mass of 1 mole gas at S.T.P.}}{\text{mass of 1 mole } H_2 \text{ gas at S.T.P.}}$

V.D. = $\frac{\text{M.wt}}{2}$

— Unitless quantity

detail (Hum log gaseous state chapter krenge)

$C_{SD} = 20$

① $V.D = \frac{M.wt}{2}$

② unitless quantity

(3) $(V.D.)_g = \frac{(M.wt)_g}{2}$

(4) $(V.D)_{mixture} = \frac{(M.wt)_{Avg.}}{2}$

Q. 0.24g of a volatile gas, upon vaporisation, gives 45 mL vapour at S.T.P. What will be the vapour density of the substance? [illegible])

A. 95.93

B. 95.39

C. 59.93

D. [illegible] None of these

$V.D = \frac{M.wt}{2} = \frac{110}{2} = 55$

22.4 litre = (M.wt) gram

45×10^{-3} litre = 0.24 gram

$22.4 \text{ litre} = \frac{0.22}{\frac{45 \times 10^{-3}}{2}} \times 22.4$

$= 0.11 \times 10^{+3}$

= 110 gram

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Q. A gaseous mixture contains 3 mole of CO_2, 6 mole of CO and 2 mole of SO_2. Average vapour density of mixture is: 44 28 64

A 17.85

B 21.65

C 19.45

D none of these

$$\text{Avg. V.D} = \frac{(\text{M.wt})_{\text{Avg.}}}{2}$$

$$= \frac{38.9}{2} = 19.45$$

$$(\text{M.wt})_{\text{Avg.}} = \frac{\Sigma M_i x_i}{\Sigma x_i}$$

$$= \frac{3\times 44 + 6\times 28 + 2\times 64}{3+6+2}$$

$$= \frac{428}{11} = 38.9$$

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Test → syllabus

Lec-1 to Lec-4

4 Question

1. Matter
2. classification of matter
3. Effect of physical state in Mole, Number, Volume, Mass ✓
4. Mole in term of Mass, Volume, Number

4 Question

8 Question → total 8 Question
→ single correct

Home work

DPP-04

Thank - You